Renewable and Sustainable Energy Reviews 15 (2011) 4286–4294

Contents lists available at SciVerse ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

A Bridge between East and West: Turkey's natural gas policy

Murat Ozturk*, Yunus Emre Yuksel, Nuri Ozek

Department of Physics, Science-Literature Faculty, Suleyman Demirel University, 32260, Cunur, East Campus, Isparta, Turkey

ARTICLE INFO

Article history:
Received 7 April 2011
Accepted 5 July 2011
Available online 14 September 2011

Keywords:
Natural gas
Energy policy
Energy security
Turkey

ABSTRACT

World energy demands have been increasing rapidly, so natural gas sources in the world play significant role in order to meet those demands. The fastest consumption growth rate of the world's primary energy sources belongs to natural gas; in addition, it has the highest consumption growth rate among the developing countries. Based on supply–demand models, declining domestic gas production in some regions will lead to a growing supply–demand gap. In fact industrial countries which are also the largest natural gas consumers will lose their key roles in the global natural gas supply in the next two decades. Middle East countries with considerable increase in gas production and due to their economical, political and geopolitical situations could be the best players in the future demand–supply scenarios. This paper deals with natural gas policy of Turkey as a bridge for energy to connect Europe to Asia and Middle East. Because of its geographical and strategic location, Turkey is in an important position to vary European countries supply. Therefore, Turkey's role for energy security of European Union has increased with current and planned natural gas pipelines that cross over Anatolia.

Contents

* Corresponding author.
E-mail addresses: muratozturk@sdu.edu.tr (M. Ozturk), yemre82@gmail.com (Y.E. Yuksel), nuriozek@sdu.edu.tr (N. Ozek).

1364-0321/$ – see front matter.
doi:10.1016/j.rser.2011.07.122

1. Introduction

Natural gas demand in the European countries grows due to the fuel's convenience and environmental benefits and, consequently, nowadays a strongly increasing dependency on imports exists. Turkey is situated at the meeting point of three continents (Asia, Europe and Africa) and stands as a bridge between Asia and Europe [1]. World's resources of natural gas, although finite, are enormous. Its size continues to grow as a result of innovations in exploration and extraction techniques. Natural gas resources are widely and abundantly distributed around the globe. In 2007 total world reserves were 181.3 trillion cubic meters (tcm) natural gas liquids reserves in the world and the ratio of proven natural gas reserves to production at current levels is between 60 and 70 years. Today, alternatives to consumption of natural gas are few and limited in availability. Based on the projection made by the OWEM and DOE/EIA model, natural gas will be the fastest growing form of energy by 2030. The most important energy agencies in the world now predict that global gas demand will continue to grow at 2.9–3.2%/year until at least 2030 (see Table 1). Demand for natural gas is rising because it is relatively low-priced; it is the cleanest burning fossil fuel [2]. These features make it essential not only to nation's energy future, but also to the challenge of reducing harmful emissions from power plants, including CO_2, the chief culprit in global warming [3]. To ensure this demand growth, worldwide net trade has more than doubled between 2001 and 2010, and is expected to more than triple by 2025. By the end of the next decade, worldwide demand for natural gas will be about 2.2 billion cubic meters (bcm) per day.

Europe will need the most remarkable import raise. Natural gas import demand is expected to grow about 65% in 2020. This is an increase of nearly 0.7 bcm/day over today's statistics. Currently, gas imports account for only 36% of European supply. The purpose of this paper is to analyze the current and projected natural gas pipelines, namely gas corridors, in Turkey with a focus on supply energy security. Turkey's geographical and strategic location makes it an energy bridge between the major natural gas producers in the Asia and the Middle East on the one hand and consumers in the European Union on the other hand.

2. Turkey's energy profile

Turkey is at the crossroads of several volatile, strategically positions and has economically important regions, including the triangle of the Middle East, Central Asia and Caucasus. At present Turkey is the world's 17th largest country in terms of economy and approximately its population are 73 million people in 2010, so Turkey's energy needs are increasing rapidly. Total final energy consumption of Turkey has grown rapidly in the last decade. The energy demand of Turkey is growing by 8% annually, one of the highest rates in the world [1]. Turkey's natural gas consumption has been gradually rising since 1980s. The Turkish Pipeline Corporation's (BOTAS in Turkish initials) natural gas demand projections show that Turkey's gas consumption will reach approximately 53.6 bcm in 2015 and 62.5 bcm in 2020, respectively [4]. Similarly oil needs are critical, with predictions that approximately 29.5 and 38.7 Mt will have to be imported annually by 2015 and 2020, respectively. Due to implication of more liberal policies since mid-80 Turkey's economy has entered a progress period and naturally its energy consumption has sharply increased. Despite being encircled by the world's largest energy-wealthy regions, Turkey can be called as an energy poor country. As a net importer, and itself a major market for producers Turkey's importance lies in its ability and willingness to develop a major transit system for gas as well as oil, enabling hydrocarbon resources to access European markets by pipeline routes from such diverse regions around Turkey, such as the Middle East, the Caspian Region and Central Asia.

Table 1
Estimated average growth of global demand (bcm).

Model	2015	%	2020	%	2025	%	2030	%
OWEM	3657	3.1	4265	3.2	4987	3.2	5860	3.3
IEA	3356	2.5	3809	2.5	4274	2.5	4836	2.5
DOE/EIA	3341	2.5	3794	2.5	5427	2.5	6290	2.5

Turkey's state-owned coal company (TTK in Turkish initials) produces, processes, and distributes hard coal, while Turkish Coal Enterprises produces most of Turkey's lignite. Turkish coal, which is used mainly for power generation, is generally of poor quality and highly polluting. According to figures from the International Energy Agency (IEA), in 2003, Turkeys total electricity consumption was 110,364 GWh. Most of the productions were supplied by hydrocarbons coal (32,253 GWh), oil (9197 GWh), the biggest part natural gas (63,535 GWh) and, on the other hand, hydro electricity (35,330 GWh). Turkey's theoretical hydroelectric potential is 1% of that of the World and 16% of that of Europe. The gross theoretical viable hydroelectric potential in Turkey is 433 billion kWh and the technically viable potential is 216 billion kWh. The economically viable potential, however, is 127 billion kWh. Turkey has a large potential for renewable energies. But renewable energies, except for hydroelectric energy, have only very minor shares in power generation in the country. At present, Turkey has 135 hydroelectric power plants in operation with total installed capacity of 12,631 MW generating an average of 45,325 GWh/year, which is 36% of the economically viable hydroelectric potential. Forty-one hydroelectric power plants are currently under construction with 3187 MW of installed capacity to generate an average annual 10,645 GWh representing 8% of the economically viable potential. In the future, 502 more hydroelectric power plants will be constructed to be able to make maximum use of the remaining 71,411 GWh/year of economically viable potential. As a result of these works, a total of 678 hydroelectric power plants with 36,260 MW will tame rivers to harness the economically viable hydropower of Turkey.

Turkey has hard coal (anthracite and bituminous) reserves of around 1.1 billion short tons, plus lignite reserves around 8 billion short tons. Around 40% of Turkey's lignite is located in the Afsin-Elbistan basin of Southeastern Anatolia, while hard coal is mined only in one location the Zonguldak basin of Northwestern Turkey.

Turkey's oil sector provides approximately 40% of Turkey's total energy requirements and it is a rapidly rising factor in the energy sector. However, its share is decreasing because of the growth of the natural gas consumption. According to Turkey's Ministry of Energy and Natural Resources, 24 Mt of oil have been exported and 2 Mt have been produced by domestic resources and oil expense, in the same year, reached 6 billion dollars [6]. Although it is surrounded by the world's hydrocarbon-richest regions, Turkey is insufficient to meet its demand. Existing gas production in Turkey meets 3% of the domestic utilization necessities. Verified oil reserves are very small. This creates an import-dependency and while oil prices are rising, as they are now, there is inevitably an impact on the economy commensurate with magnitude of price [7]. Turkey's main oil suppliers are Saudi Arabia, Iran, Iraq, Syria and Russia. The share of the Caspian oil in the Turkey's energy market is rising and will continue to do so thanks to constructed and projected oil pipelines.

Turkey's domestic energy production, distribution and energy transit infrastructure are still predominantly in the hands of state-owned companies. Turkey's oil production belongs to three companies. These are the Turkish State Petroleum Company (TPAO in Turkish initials), and foreign operators Royal Dutch/Shell (Shell) and ExxonMobil. About 80% of the country's total oil output belongs to TPAO.

Table 2
Turkey's primary energy resources referring to 2009 [5].

Sources	Apparent	Probably	Possible	Total
Hard coal (Mt)	534.6	431.5	368.4	1334.5
Lignite (Mt)	9837	1344	262	11,445
Asphaltite (Mt)	40.2	29.4	7.3	76.9
Bituminous Schist (Mt)	555	1086	–	1641
Hydropower (MW)	36,603	–	–	36,603
Crude oil (Mt)	42.8	–	–	42.8
Natural gas (bcm)	8	–	–	8
Nuclear sources				
Uranium	9.1	–	–	9.1
Thorium	380	–	–	380
Geothermal (MW)				
Electric	98	–	412	510
Heat	3348	–	28,152	31,500
Solar (Mt/year)				
Electric	–	–	–	–
Heat	–	–	–	32.6
Biomass (Mt/year)				
Electric	–	–	–	2.6
Heat	–	–	–	6

Turkish oil fields are generally small, and scattered around the country. Oil fields in the country's Southeast (specifically the Hakkari Basin, Turkey's main oil producing area) are old and expensive to exploit. In addition to the Hakkari Basin, Turkey contains oil prospects in its European provinces, in the Black Sea shelf region, and there are also other oil basins in Southern and Southeastern Turkey. Potential oil reserves in the Aegean Sea have not been explored due to conflicting Greek claims over the area. TPAO stated that it has been continuing large-scale explorations for oil and gas in the Black Sea, Mediterranean, and Aegean Seas since 2004 (plus Southeastern Turkey) [8]. With great perseverance, enthusiasm and expectations, TPAO has given priority to realize exploration, drilling and production investment programs also onshore fields. Offshore exploration-drilling operations are being carried out intensively. In this scope, TPAO has drilled 2 offshore wells in the Western Black Sea through POAS-TOREADOR (TIWAY-OIL) -STRATIC partnership in 2009 (Table 2).

Natural gas became important in the 1980s for Turkish energy sector and gas tapped in Thrace was piped to Istanbul, which is the biggest city in Turkey, and used to produce electricity, thereby reducing the need for electricity imports from Bulgaria. In 1986, Turkey began the construction of a pipeline to carry Soviet natural gas from the Bulgarian border to Ankara, which is the capital of Turkey, in order to reduce greenhouse emissions and continued, respectively, with Istanbul and Bursa 1992, and then Eskisehir and Izmit in 1996 [9]. Today natural gas began to be used for residential and commercial purposes in many cities in country. The sectoral natural gas demands in Turkey are given in Table 3.

By 2010, over 31% of Turkey's gas imports have been supplied from Russia via the Black Sea, more than 27% from Russia via Bulgaria, about 19% from Iran, about 13% from Azerbaijan, and the remainder from Algeria and Nigeria. Under the "take-or-pay" provisions of natural gas supply contracts with countries like Iran and Russia, Turkey theoretically could be forced to pay cash penalties of up to $1 billion per year if it fails to purchase contracted gas. In this context, Turkish energy officials have discussed the possibility of storing surplus natural gas in underwater depots beneath the Sea of Marmara or under the Salt Lake in central Anatolia. The bulk of Turkish gas demand is met by imports, approximately more than half by Russia. Turkey would like to diversity its import sources and has signed gas imports deals with a number of countries, as seen in Table 4. These natural gas imports agreements between Turkey and other countries are held by BOTAS.

Turkey is not only a major natural gas consumer but also does not have significant reserves. Turkish industrial and household users are thus dependent on natural gas imports. Natural gas sale and purchase agreements have been signed with Russia. Turkey has contracted to receive 30 bcm/year of natural gas from Russia by 2010. Of this amount, 16 bcm/year has been delivered by the Blue Stream project, which involves the use of twin parallel pipelines laid across the Black Sea. Turkey has also contracted to receive up to 10 bcm from Iran by 2007.

Sale and purchase agreements have also been finalized with Azerbaijan and Turkmenistan. The first gas from Shah Deniz arrived in Turkey in 2006 after the completion of the Baku–Erzurum pipeline. By 2010 Turkey has consumed 6.6 bcm/year of natural gas from Shah Deniz. Officials in Ankara plan to import 16 bcm/year of gas from Turkmenistan once this gas reaches the Turkish border. This will not be possible in the foreseeable future, though, because of the collapse of the Trans-Caspian Gas Pipeline Project, which has planned to lay a pipeline under the Caspian Sea. The Turkmen authorities appear to be more interested in selling their gas to markets in Russia and Ukraine, and possibly eventually to Pakistan and India. It is important to note that the Baku–Erzurum gas pipeline will not have spare capacity to carry Turkmen natural gas to Turkey. Turkey also imports 4 bcm/year and 1.2 bcm/year of LNG from Algeria and Nigeria, respectively.

3. Turkey's energy policy as a transit country

The 1970s created new objectives for Turkey as well as the rest of the Western world whose resources were not enough to meet their demand. Oil crises of the 1970s and sky-high oil prices, caught Turkey off balance and caused the worst economic crisis in its history. Turkey was severely affected by the oil price increasing in 1973. During the years following the first oil crisis, economic conditions deteriorated, with high unemployment, a nearly five-fold increase in the balance of payments deficit between 1973 and 1979, large external debt and annual inflation rates exceeding 100% in 1980 [10]. Turkey's economy requires growing new raw materials, however; limited domestic natural resources oblige her to meet its demand by buying from external resources. Therefore, energy policy of Turkey has direct links with her foreign policy. The density of Turkey's demand from outside, which means that 74% of the total primary energy consumption needs a supply of energy from surrounding regions and countries, has been increasing year by year. Therefore, Turkey's relation with the countries which imports its energy is a critical issue in terms of foreign policy. In addition, Turkey's geopolitical location is one of a crossing state for the countries with energy resources to export. Thus, the

Table 3
Natural gas demand for different sectors in Turkey.

Years	Electricity		Household		Industry		Fertilizer		Total (bcm)
	bcm	%	bcm	%	bcm	%	bcm	%	
1988	1.02	59.68	0.21	12.09	0.001	0.06	0.48	28.17	1.71
1989	2.71	74.46	0.44	12.16	0.007	0.20	0.48	13.18	3.64
1990	2.56	65.24	0.81	20.75	0.05	1.25	0.50	12.76	3.92
1991	2.87	61.22	1.15	24.54	0.19	3.99	0.48	10.25	4.69
1992	2.60	49.47	1.64	31.10	0.37	7.07	0.65	12.36	5.26
1993	2.53	43.05	2.01	34.11	0.55	9.41	0.79	13.43	5.88
1994	2.93	48.87	1.64	27.46	0.81	13.49	0.61	10.18	5.99
1995	3.60	46.99	2.34	30.53	0.99	12.96	0.73	9.52	7.66
1996	3.79	42.41	2.43	27.21	1.89	21.10	0.83	9.28	8.94
1997	4.57	42.20	3.04	28.07	2.46	22.71	0.76	7.02	10.83
1998	5.48	49.27	2.50	22.43	2.66	23.90	0.49	4.40	11.13
1999	7.57	58.53	2.35	18.18	2.88	22.21	0.14	1.08	12.94
2000	9.49	62.50	2.31	15.24	3.27	21.54	0.11	0.72	15.18
2001	10.52	63.99	2.91	17.71	2.89	17.58	0.12	0.72	16.44
2002	10.54	58.87	3.96	22.14	2.91	16.26	0.49	2.73	17.90
2003	12.46	57.68	4.79	22.20	3.87	17.94	0.47	2.18	21.59
2004	12.67	55.18	5.38	23.46	4.38	19.09	0.52	2.27	22.95
2005	15.76	56.29	5.88	21.00	5.84	20.85	0.52	1.86	28.00
2006	17.03	53.91	7.04	22.29	7.22	22.86	0.30	0.94	31.59
2007	20.05	55.50	8.02	22.20	7.76	21.48	0.30	0.82	36.13
2008	20.91	57.71	7.10	19.60	7.92	21.86	0.30	0.83	36.23
2009	20.48	59.53	6.01	17.48	7.61	22.12	0.30	0.87	34.40
2010	22.22	58.58	7.27	19.18	8.13	21.44	0.30	0.80	37.92
2015	31.32	58.42	10.67	19.89	11.38	21.13	0.30	0.56	53.67
2020	35.75	57.23	12.64	20.24	13.78	22.05	0.30	0.48	62.47

Adapted from Ref. [5].

issues of energy security, energy diplomacy and a national energy strategy in Turkey's foreign policy are a concern not just for Ankara, but also for many related countries and Europe.

Turkey's national energy policy consists of three components. First one is the energy diversity. It means that, diversification of the energy sources and exporter countries in order to avoid becoming dependent on just one country's reserves. In other words, Turkey wants to ensure that it is not absolutely dependent on any one country for more than 35–40% of its energy. The second one is to ensure a sustainable, high quality and cheap energy supply. The third is to function as a bridge of energy by maintaining the country's geopolitical opportunities. For the last decade, Turkey has endeavored greatly in order to implement this policy. The Baku–Tiblisi–Ceyhan (BTC) pipeline, or East–West, North–South pipeline projects criss-crossing Turkey, is the result of this policy.

The liberalization of the energy markets of Turkey is also dominating her agenda. Turkey has embarked on the liberalization of the energy sector in line with the EU directives. The turning point in energy markets occurred in 2001, when two laws were enacted to end the state's monopolies in power and natural gas. This was followed by a series of other laws on the electricity market licenses (2002), oil market (2003) and renewable energy (2005, 2007 and 2010). The massive restructuring through legal and institutional arrangements in the electricity, oil and natural gas sectors encourages new and competitive investments. The energy sector generates significant investment opportunities due to three factors: (1) the country's growing energy demand, (2) its role as a transit country, and (3) market liberalization. Despite having more than one aspect, present and prospective pipeline infrastructure is the main component of the Turkey's energy policy to determine country's economic and international political status.

3.1. *Rich energy reserves of Turkey's neighbors*

In this geographical position, Turkey directly or indirectly borders the oil and gas rich areas of the world. Surrounding regions, Middle East, North Africa, Caspian Basin and Russian Federation are all rich in oil and gas reserves. Among them, the latest reserves have been discovered in Caspian Sea. In the Caspian region, Kazakhstan, Turkmenistan and Azerbaijan are the countries that have substantial gas and oil reserves [11]. Even if the proven reserves are far less than the first estimations for the region, it has still considerable oil and gas reserves. Kazakhstan has the largest proven oil and gas reserves in the region (3.3% and 1.7% of the world proven reserves at the end of 2004). Turkmenistan has also considerable proven gas reserves as 1.6% [12]. While Azerbaijan does have smaller reserves in quantity, its location is closer to the European markets. In this context, Turkey is the closest way

Table 4
The distribution of Turkey's natural gas exports (bcm).

Years	Russia Fed. (West)	%	Russia Fed.	%	Iran	%	Azerbaijan	%	Algeria	%	Nigeria	%	Total
2000	10	69.94	–	–	–	–	–	–	3.6	25.17	0.7	4.89	14.3
2001	10.9	68.98	–	–	0.1	0.64	–	–	3.6	22.79	1.2	7.59	15.8
2002	11.6	67.06	–	–	0.6	3.47	–	–	3.7	21.38	1.4	8.09	17.3
2003	11.2	53.86	1.2	5.76	3.5	16.84	–	–	3.8	18.26	1.1	5.28	20.8
2004	11	50.23	3.2	14.61	3.5	15.99	–	–	3.2	14.61	1	4.56	21.9
2005	12.6	47.73	4.8	18.18	4.2	15.90	–	–	3.8	14.40	1	3.79	26.4
2006	12	39.74	7.3	24.17	5.6	18.55	–	–	4.2	13.90	1.1	3.64	30.2
2007	13.5	39.14	9.2	26.67	6	17.39	1.2	3.47	3.2	9.27	1.4	4.06	34.5
2008	13.1	35.60	9.8	26.63	4.1	11.14	4.6	12.5	4.2	11.41	1	2.72	36.8
2009	7.7	23.48	9.5	28.97	5.2	15.85	5	15.24	4.5	13.72	0.9	2.74	32.8

located between these reserves and the European market. Turkey has also linguistic and cultural ties with those energy rich countries that give an important advantage to Turkey. Secondly, Iran has the world's second largest gas reserves after Russia. Mainly for political reasons, Iran is mostly interested in the European energy market. In that sense, neighboring Turkey is the easiest way for Iranian gas to reach Europe, both geographically and in terms of infrastructure availability. Iraq is the other direct neighbor of Turkey having great amount of proven oil reserves with its share of 9.4% in total world reserves [13]. When Iraq becomes stable and regains its full production capacity after the regime change, it will become an important oil supplier for Europe. Existing, but idle, Kerkuk–Ceyhan oil pipeline passing through the Anatolia will be the main outlet for the Iraqi oil to the European energy market. Nowadays, pipelines in Iraq are under attacks, so Iraq oil export via Turkey is rather indefinite for the short-term.

Lastly, Russia is the world's largest gas producer with its proven reserves up to 26.4% of total world reserves. It has also considerable oil reserves as 6.5% share. Russia is also the most stable producer in the region having the greatest number of infrastructural connections. It is also one of the most important players in the region owing to its imperial ties with the post-Soviet countries. Even though Russia showed a relative weakness in the early 1990s after the collapse of USSR, it has regained its dominant role on the Newly Independent States (NIS) in a short period of time. This so called "near abroad" policy of Russia has become the main rival to Turkish and American interests in the Caspian region. We see that "More than 35% of Russian oil exports and substantial quantities of its petroleum products are transported via Turkey (the Black Sea Straits)" [14]. Concerning natural gas, Russia does not hold the idea to transit it via Turkey at the moment. Instead, Russia seeks alternative ways to transport Caspian gas and oil by its own initiatives. Nevertheless, Turkey opposes to any route passing through the straits due to environmental worries. The question if this competition turns into cooperation remains unclear for the near future. Today, natural gas accounts for 25% of world primary energy production. Approximately 73% world's proven crude oil reserves and 72% of world's proven natural gas reserves are located in the surrounding regions, which are the Middle East, Caspian Region and Russia, of Turkey, as seen in Table 5. This makes Turkey a natural bridge between energy rich regions and European countries, which spend approximately $320 billion per year for imported natural gas and oil. This gives an important geostrategic advantage to Turkey in world politics.

4. Energy bridge between East and West

It is possible to say that, energy and sources of energy are directly related with the countries and region's destiny. In the European Union (EU) membership process, Turkey will realize many modifications in its domestic laws and regulations and in this frame there will be various projects concerning environment and energy both funded by the EU and by Turkey [17]. In the energy sector, the projects mainly include natural gas distribution license, pipeline projects and privatization. BOTAS' natural gas contract tender and the privatization of electricity distribution facilities are considered major steps in this sector. European countries spend $300 billion each year for energy imports and almost three quarters of global gas reserves are in the Caspian region, Middle East and Russia. In the next two decades, European demand is expected to increase from 472 to 786 bcm [18]. Natural gas and oil demands of EU are given in Table 6. Turkey is trying to be an important part of the link between increasing demand and supply. It is planning to build new gas supply routes, increase co-operation between the neighboring countries and press on the integration of Turkish and European natural gas markets. The integration to the EU energy market is expected to bring diversity in resources, supply security and incentives for a competitive market [19].

Turkey's role as a gateway through which oil and gas enter the EU is becoming increasingly important as the EU deals with the interrelated problems of ensuring energy security and the provisions of energy supplies from multiple sources at competitive prices. A net importer, and itself a major market for regional producers, Turkey's importance lies in its ability and willingness to develop a major transit system for oil and gas, thus enabling hydrocarbon resources to access European market by pipelines from such diverse regions as the Caspian Sea, Central Asia, the Gulf, and the eastern Mediterranean.

4.1. Existing pipelines in Turkey

4.1.1. Kirkuk–Ceyhan crude oil pipeline

Kirkuk oil was discovered in 1927 and it still produces up to 1 million bl/d, almost half of all Iraqi oil exports. The Iraq–Turkey Crude Oil Pipeline has been constructed within the frame of the Iraq–Turkey Crude Oil Pipeline Agreement that was signed on 27 August 1973 between Turkey and Iraq. Its main goal is transporting the Iraqi crude oil produced mainly in the Kirkuk Region and other areas of Iraq to the Ceyhan–Yumurtalik Terminal. Initially a 986 km long system with an annual transport capacity of 35 Mt/year was commissioned in 1976 and the first tanker was loaded on 25 May 1977. The first pipeline has proved that the pipeline is vital for Iraqi oil transport to Europe's energy market. As a result, expansion of the first pipeline and the construction of the second pipeline have been decided [21]. The First Expansion Project which has increased the capacity of the line to 46.5 Mt/year, was completed in 1984. Then the expansion of the second Pipeline, which is parallel to the first one, was started in 1985. In 1987, the Second Pipeline was completed with a 890 km distance system and the annual capacity reached 70.9 Mt/year. Following conflict in Iraq, delivers were resumed in February 2004 but have remained well below full capacity. In 2009, around 23.3 Mt were transported from Iraqi oilfields to Ceyhan. A Memorandum of Understanding concerning the renewal of "Crude Oil Pipeline Agreement between the Government of the Turkish Republic and the Government of the Iraqi Republic" was signed on 15 October 2009 between Turkey and Iraq. Studies are ongoing in this respect and the new agreement is expected to be concluded soon [22].

4.1.2. Baku–Tbilisi–Ceyhan crude oil pipeline

Line fill of the Baku–Tbilisi–Ceyhan (BTC) pipeline started at 10 May, 2005 and on 28 May 2006, the first crude oil arrived at the Ceyhan port of Turkey on Mediterranean and a new age has been opened for the participants of the pipelines as well as Caspian region states. The fate of Central Asian and Caucasian oil under Russia's control until then changed when Azerbaijani-produced oil in the Caspian Sea was pumped to Ceyhan through the BTC pipeline. It would not be a far-fetched assumption to say that not only the fate of Caspian oil but also the fate of Caspian countries changed [23]. For the last 15 years, strategists have been preoccupied with how Russia, which has been increasingly using its oil and natural gas as a political weapon, would act in delivering Caspian energy resources to the world market and whether it would place countries of the region in a difficult situation, in such a situation where a pipeline such as the BTC did not exist [24]. BTC aims to harmonize the legal and technical standards for the energy sector, to improve energy supply and demand management, to enhance the safety and security of energy supplies, to promote the financing for commercially and environmentally viable energy projects of common interest.

In November 1999, Azerbaijan, Georgia, and Turkey signed agreements affirming the BTC route as the Main Export Pipeline for Azeri oil exports. The pipeline is projected to start from the

Table 5
Natural gas and oil potentials of Turkey's neighbors, 2009 [15,16].

	Natural gas		Oil	
	bcm	%	Mt	%
World	182.3	100	165,348	100
Turkey's neighbors	132.2	72.51	102,939	62.26
Russian Federation	48.1	26.38	10,700	6.47
Iran	29.0	15.90	18,450	11.16
Qatar	25.5	13.98	1853	1.14
Saudi Arabia	7.5	4.12	34,542	20.90
United Arab Emirates	6.4	3.51	12,555	7.59
Algeria	4.5	2.47	2731	1.66
Iraq	3.1	1.71	15,478	9.36
Turkmenistan	2.9	1.59	81	0.04
Egypt	2.1	1.15	561	0.33
Kazakhstan	1.8	0.98	5038	3.04
Azerbaijan	1.3	0.72	950	0.57

Sangachal Terminal Station, near Baku, and reach Ceyhan via Georgia, following the Erzurum–Erzincan–Kayseri route. At the beginning, the Turkish option for structuring pipeline was the most difficult because the pipeline had to pass through the mountainous regions. In addition, its cost was more than the other routes. On the other hand, BTC route had an advantage, having direct access to the Mediterranean for the filling of tankers. When the Ceyhan and Novorosisyk are compared (Novorosisyk is a port of Russia on the Black Sea and an alternative for the Ceyhan), the superiority of the Ceyhan is easily understood. Ceyhan can handle the largest tanker in service, far larger than the size that can navigate the Bosphorus, and has four times more capacity than that of Novorossiysk, 130 Mt a year versus 32 Mt [25].

The BTC pipeline connects the Azeri–Chirag–Gunashli oil fields to Turkey's Mediterranean port city Ceyhan through Baku, Azerbaijan, and Tbilisi, Georgia. As the world's second longest pipeline at 1768 km (1076 km in Turkey, 443 km in Azerbaijan and 249 km in Georgia), the majority of which is far underground, and with a path that traverses a politically unstable region, the BTC pipeline has been criticized for being prone to sabotage or malfunction. The pipeline's output capacity is one million barrels of oil per day. Western leaders, hence, hail it as one of the most important projects of the 21st century. The World Bank's International Finance Corporation and the European Bank for Reconstruction and Development funded $4 billion to the project. Energy Company BP is the main operator and controls a 30.1% share in the pipeline. Other major contributors include State Oil Company of Azerbaijan (SOCAR), American firms Unocal Corp. and Chevron, Norway's Statoil, Turkish state oil firm TPAO, and Italy's Eni SpA.

The BTC Crude Oil Pipeline is one of the most imperative energy projects that Turkey has ever performed with respect to the associated political, economical, strategic and environmental aspects. On economical basis, Turkey will be able to purchase crude oil at a lower price. The main reason for this will be the minimization of transportation costs. Another reason will be the dwindling of financial costs. It is very well known that the BTC Crude Oil Pipeline is of great importance for Turkey and the countries. Turkey's gas interconnection projects are following the same road towards a promising future that will turn the country into an energy bridge between the continents [26]. Therefore, the BTC Pipeline is envisioned as the milestone of an "East and West transportation corridor" linking the South Caucasus and Central Asia to Turkey and the Mediterranean Sea. This pipeline has also brought forward the advantage of avoiding the risks associated with the passage through the congested Turkish Straits.

4.1.3. Russia–Turkey West natural gas pipeline

As a result of seeking alternative energy sources and diversifying energy generation, an Intergovernmental Agreement was signed for the supply of natural gas between the Governments of Turkey and Russia on 18 September 1984. In 1985, BOTAS prepared a "Natural Gas Utilization Study" in order to determine Turkey's natural gas demand potential and the possible route for the pipeline. On 14 February 1986, Natural Gas Sale and Purchase Agreement, which was based on BOTAS's study, was signed between BOTAS and SOYUTAZEXPORT for a 25-year period. According to this Agreement, supply of natural gas to Turkey started in 1987 and the volume transported has been slowly increased to reach 6 bcm/year in 1993. In 1998, BOTAS signed another agreement with Russia to import 8 bcm/year of natural gas from the West through TURUSGAZ. It is a BOTAS, GAZPROM and GAMA joint venture. The 842 km long Russia–Turkey Natural Gas Main Transmission Line enters Turkey at Malkoclar at the Bulgarian border and then follows Hamitabat, Ambarli, Istanbul, Izmit, Bursa, Eskisehir route to reach Ankara. The pipeline reached Ankara in August 1988. The consumption of natural gas by the industrial sector started in August 1989 and natural gas has been consumed by various industrial plants along the route in different sectors since then. Following Ankara, residential and

Table 6
Natural gas and oil demands of European countries [20].

Countries of EU	Natural gas (bcm)	%	Countries of EU	Oil (Mt)	%
Germany	72.83	23.57	Germany	111.45	19.55
Italy	70.69	22.87	France	87.17	15.30
France	43.92	14.21	Spain	73.18	12.84
Spain	39.67	12.84	Italy	70.02	12.28
United Kingdom	24.77	8.01	Netherlands	46.76	8.21
Belgium	16.77	5.42	Belgium	31.49	5.52
Hungary	10.47	3.38	Poland	23.39	4.11
Poland	10.27	3.32	Greece	20.07	3.52
Czech Republic	7.91	2.56	Sweden	15.99	2.81
Austria	7.33	2.38	Austria	11.90	2.10
EU17	4.45	1.44	EU17	78.45	13.76
EU27	309.08	100	EU27	569.87	100

commercial use of natural gas started in Istanbul, Bursa, Eskisehir and Adapazarı.

4.1.4. The Russian route pipeline connections (Blue Stream)

Turkey also has another pipeline infrastructure to meet its demand. Due to its huge reserves and production capacity, there are currently, two different pipeline links with Russia. First one is the Western Route that has been in use since 1997 and crosses Ukraine, Moldova, Romania and Bulgaria and finally reaches Turkey. The Capacity of the Western Route is 14 bcm, however, from the Russian point of view this line is not reliable because of the illegal "siphoning" of their gas on the way before it reaches to Turkey. Therefore, one of the biggest projects for Turkey has been started to be constructed: Blue Stream which has been in use since December 2002. The $3.2 billion "Blue Stream" pipeline consists of three main parts. The route comprises of a 373 km section in Russia from the town of Izobilnoye to Dzhugba on the Black Sea Coast, a 396 km section on the bottom of the Black Sea connecting Dzhugba to the Durusu terminal located 60 km off the city of Samsun on the Turkish coast (submarine section) and a further 444 km link from Durusu (Samsun) to Ankara (Turkish onshore section).

Even though the flow through the pipeline totalled only 3.2 bcm during 2004, the recent launch of a new gas compressor station in Russia will allow the pipeline to run at its design capacity of 16 bcm/year. During 2005, roughly 4.5 bcm of natural gas has been transported via Blue Stream. Russians are proposing to extend this line from Ankara (the existing line transports gas from Samsun port to Ankara) to Ceyhan or Izmir. In addition, there are further plans are to transport additional volumes of gas to Israel either by a subsea pipeline or by LNG tankers from Ceyhan.

4.1.5. Turkey–Greece natural gas pipeline

Turkey–Greece Natural Gas Pipeline Project is developed as a result of the studies undertaken for the interconnection of natural gas grid of Turkey and Greece and creation of South Eastern Gas Ring. The economic feasibility study of the Turkey–Greece Natural Gas Pipeline Project has been conducted by Society General with equal financial supports of EU-TEN Funds and DEPA. On 28 March 2002 in Ankara, the Director of BOTAS and DEPA of Greece have signed the Memorandum of Understanding regarding natural gas sale and purchase, natural gas transmission to Europe and Balkans via Turkey and Greece and LNG swap between the companies.

Under the framework of European Commission INOGATE Program (Interstate Oil and Gas Transport to Europe), South European Gas Ring Project has been developed for the purpose of transporting the natural gas produced in Caspian Basin, the Russian Federation, the Middle East, the Southern Mediterranean countries and other international sources via Turkey and Greece to European markets. Within the framework of the studies conducted, the first step is the connection of natural gas networks of both countries by a pipeline to be constructed in order to create the South European Gas Ring. A pipeline starting from Karacabey in Turkey, crossing the Marmara Sea with a distance of 17 km, entering into Greece from Ipsala/Kipi border point and ending in Komotini was envisaged at the Desk Study. The pipeline has a span of 296 km of which 211 km lies in Turkey and 85 km in Greece. The quantity of gas supplies to Greece in 2006 was 0.25 bcm, whereas it will subsequently reach to 0.75 bcm/year soon. The constructions of the Land Section (Lot-I) was completed on July 30, 2007, the Sea Section (Lot-II) was completed on July 05, 2007 and Meriç-Evros River Crossing (Lot-III) was finished on August 18, 2007. The Pipeline construction started in 2005, was completed and became operational on November 18, 2007.

4.1.6. Azerbaijan–Turkey natural gas pipeline (Shah Sea)

Azerbaijan–Turkey Natural Gas Pipeline (Shah Sea), which is one of the most important steps for Turkey aiming to be an energy bridge between the East and West, is aimed at transporting the natural gas produced in Azerbaijan via Georgia to Turkey. Negotiations which started in October 2000 for the supply of natural gas from Shah Sea in Azerbaijan were finalized in March 2001 and Intergovernmental Agreement was signed by Ministry of Energy and Natural Resources of Turkey and Deputy Prime Minister of Azerbaijan on 12 March 2001. Natural Gas Sales and Purchase Contract was signed by BOTAS and SOCAR (State Oil Company of Azerbaijan) on the same date as well. According to the contract; natural gas delivery for 15 years is going to start with 2 bcm and reach 6.6 bcm on the intended period. Under the contract, the delivery point would be Turkish/Georgian border. BOTAS would be the sole responsible for the construction and operation of the line within the Turkish territories while SOCAR would be the responsible one for the section of Azerbaijan through Georgia. As a result of the contract; it is determined that 225 km long line would carry Azeri gas to integrate Eastern Anatolia Transmission Line at Erzurum–Horasan. Prefeasibility studies of the project were completed and tenders are to be launched for the construction of the line.

4.1.7. Iran–Turkey natural gas pipeline

In late January 2002, Iran and Turkey officially inaugurated a much-delayed natural gas pipeline link between Tebriz (Northern Iran) and Ankara (the capital of Turkey). In 1996, Iran and Turkey had signed a $30 billion, 25-year agreement that called for Iran to supply Turkey with more than 10 bcm/year of natural gas beginning in late 1999. Officials in Turkey and Iran variously blamed U.S. sanctions, financing problems on the Turkish leg of the $1.9 billion pipeline, economic recession in Turkey, and delays by the Iranians in completing an important metering station for delaying the project. Actually according to the first contract, Iran was to export to Turkey a total of 192 bcm of Iranian gas over 22 years, with deliveries starting in January 2000. However, when deliveries were scheduled to start, BOTAS had not completed the necessary import infrastructure, and an amendment to the original deal was negotiated under which first gas was delayed until July 2001, and the duration of the contract was extended to 25 years. The total contractual volume was also increased to 228 bcm, with scheduled to reach their plateau level of 10 bcm/year in 2007. But again, when the July 2001 arrived, BOTAS, claimed that Iran had not constructed the necessary border metering facilities, and the gas did not actually start flowing until January 2002 [27].

4.2. Pipeline projects–incoming pipelines to Turkey

4.2.1. Bosphorus by–pass projects

Turkey's Straits (Bosphorus and Dardanelles) are a major shipping "choke point" between the Black and Mediterranean Seas. The current oil tanker transportation volumes have been as high as 140 Mt/year and have reached to 200 Mt/year by 2010. Even if BTC were functional, Turkey would still have unacceptable dangerous tanker traffic load to threaten the Straits and Istanbul city. Turkish Straits are accepted to be among the most dangerous waterways of the world. Only half a mile wide at its narrowest point, with strong currents in opposite directions, Bosphorus is among the busiest and hardest to navigate waterways. For that purpose, there are several "Bosporus Bypass Projects" proposed. The most important "customers" of the Straits are the tankers loaded with Russian oil and the new regulations implied by Turkish authorities or security and environmental concerns caused delays and therefore reactions of the Russian Federation [28]. Since International Maritime Organization rejected the Russian objections, now they are proposing Turkish Straits "bypass" pipelines categorized

as Trans-Thrace Pipelines. On the contrary, Turkish authorities are favoring Samsun–Ceyhan Pipeline aimed to transport the oil reaching to the Black Sea port of Samsun (Turkey) via Turkey to its Mediterranean port of Ceyhan.

4.2.2. Transcaspian Turkmenistan–Turkey–Europe natural gas pipeline project

The aim of the Turkmenistan–Turkey–Europe natural gas pipeline project is to transport natural gas produced in Turkmenistan via the Caspian Sea to Turkey and then to Europe. A Framework Agreement was signed by Turkey and Turkmenistan on October 29, 1998 for the implementation of the Turkmenistan–Turkey–Europe natural gas pipeline project. According to this agreement, 30 bcm of Turkmen gas would be transported through this pipeline, with 16 bcm being supplied to Turkey and the remainder to Europe. A Natural Gas Sale and Purchase Agreement valid for 30 years were signed on May 21, 1999 by BOTAS and the Authorized Body for the Use of Hydrocarbon Resources of the President of Turkmenistan.

4.2.3. Iraq–Turkey natural gas pipeline project

The Iraq–Turkey natural gas pipeline project was developed for the purpose of transporting Iraqi gas to Turkey. The project studies were first initiated by the agreements that were signed by the Ministry of Energy and Natural Resources of Turkey and the Iraqi Petroleum Minister on 26 December 1996 after the studies of the Working Group were formed by BOTAS-TPAO and TEKFEN. This project is an integrated one including field development, production, and processing and pipeline transportation of gas from the Northeastern part of Iraq. Accordingly 10 bcm of gas to be produced in five gas fields would be transported to Turkey. As a result of the sanctions imposed on Iraq by the United Nations, the Project has been delayed. In the light of the developments in Iraq and increasing gas demand in Europe, currently BOTAS-TPAO and TEKFEN are taking the necessary steps in order to push the project further. The ultimate purpose of the project is firstly to transport Iraqi gas to Turkey and subsequently to Europe through Turkey. Studies will be conducted for preparation of Frame Agreement, Production Sharing Agreement and to negotiate for establishing Joint Operation Company and the Consortium to steer the project. Furthermore, if economically viable, priority may actually be given to the delivery of Iraqi natural gas to Europe Union via Turkey. This would not only help to enhance European energy security, but also provide the EU with an important economic co-operation prospect with Iraq. Such a scheme would provide Turkey with additional economic benefits through transit fees, as well as adding Turkey's role in the European energy equation.

4.2.4. Egypt–Turkey natural gas pipeline project

The Egypt–Turkey natural gas pipeline project was developed for the purpose of diversifying the supply sources and to meet some Turkish of gas demand by importing natural gas from Egypt [29]. Regarding the Project, a Framework Agreement was signed by Turkey and Egypt on March 17, 2004 in Cairo, for the import of natural gas by BOTAS from Egypt Natural Gas Company EGAS and the transit of gas from Egypt to Europe through Turkey. According to the Agreement Egypt would export 2–4 bcm of natural gas to Turkey and 2–6 bcm to European markets through Turkey. As a result of negotiations held in Istanbul on 16 February 2006, a Memorandum of Understanding (MoU) was signed by Turkey and Egypt for continuance of cooperation and collaboration between the two countries in natural gas supply. Under this MoU working groups were formed with the participation of Syria and studies initiated for the feasibility of the Project and its requirements. Related studies were conducted with related ministries and also with working groups.

4.2.5. The Nabucco project

This is particularly true of the Nabucco project, which, if it is developed in the way its promoters envisage, it will help a lot to establish Turkey as the Europe's fourth artery. However, it should also be noted that the EU's consistent backing of a Turkey–Greece–Italy interconnector has a strategic underpinning. The extent of detailed planning and, in particular, its development by prospective gas importers makes it look increasingly probable that the next few years will see the development of at least one major pipeline system for delivery of Eurasian gas to Europe via Turkey: the Nabucco project. The studies regarding the project were started in February 2002 by the initiative of BOTAS with the working groups formed by OMV Erdgas (Austria–today OMV Gas), BULGARGAZ (Bulgaria), TRANSGAZ (Romania) and MOL (Hungary) with BOTAS. Five partners of the Project established "The Nabucco Company Study Pipeline GmbH" in Vienna in order to develop the project finance model, to search for suitable incentives for investors, to coordinate marketing activities as well as to negotiate the contracts with potential suppliers. Afterwards, a "Cooperation Agreement" was signed in 2004 by the partners [30]. This Agreement would enable the execution of extended works covering project engineering, construction and financing studies. Considering the developments and the needs of the Nabucco Project, the partners have transformed the company to Nabucco Gas Pipeline International (NIC) in order to be able to realize the investments and to provide finance. The partners have also agreed to establish Nabucco National Companies (NNC) in each of the transit countries.

The national companies are obliged to develop, construct, operate and maintain the part of the line in their territories. National companies in Austria, Romania, Hungary and Bulgaria have already been established, while the legal procedures in Turkey are currently underway. The Nabucco line is planned to have a capacity of 25–30 bcm/year as it crosses Turkey. The transit countries would themselves take around 8–10 bcm/year, so deliveries to Baumgarten would be around 17–22 bcm/year. The partners in the project have all agreed to meet at least part of their own domestic demand by means of Nabucco. During the mid-2004, a new Vienna-based venture set up to coordinate the project, the Nabucco Company Pipeline Study GMBH, was incorporated, with gas companies in Austria, Turkey, Hungary, Romania and Bulgaria each holding a 20% stake and with France's Gasunie showing interest in becoming a member. The Turkey–Bulgaria–Romania–Hungary–Austria natural gas pipeline (Nabucco Line), which is envisaged to transport Caspian and Middle East gas to European Markets, will supply natural gas to the countries on its route in the first phase. The target for the following years is to reach the Western European market to meet their demands through Austria, which is a gas hub. The total capacity of 3300 km pipeline will be 25.5–31.0 bcm and the line will become operational in 2015. The gas to be produced in Azerbaijan, Turkmenistan and other Caspian sources as well as Iran will be the source for the line. The natural gas from Iraq and Egypt through Syria is planned to be transported in the long term. Contractual conditions between suppliers and buyers will be crucial. The IEA and the Energy Charter Secretariat (ECS) noted that what they termed non-price differentiation may be a key element in developing competition with existing sources. By this, they meant structuring contracts in new ways that are more attractive to buyers, such as short- to medium-term contracts and the introduction of price indexation systems that are not dependent on oil prices.

4.2.6. Turkey–Greece–Italy natural gas pipeline project

The Southern Europe Gas Ring Project was developed to transport natural gas supplied from sources located in the Caspian Basin, Russian Federation, the Middle East, Southern Mediterranean countries, and other international sources through Turkey and Greece within the scope of the INOGATE Programme (Interstate Oil and Gas Transport to Europe) of the EU Commission. The section of the Turkey–Greece natural gas pipeline within the Turkish territory starts from the existing Karacabey Pig Station and ends in Ipsala/Kipi. The line includes a 17 km-long off-shore section beneath the Marmara Sea and will be approximately 300 km long of which 209 km is within the territory of Turkey. The Intergovernmental Agreement between Turkey and Greece was signed in Thessalonica on February 23, 2003. Later on December 23, 2003 Natural Gas Sale and Purchase Agreement was signed by BOTAS and DEPA. The construction of the line that was initiated on July 2005 was completed and gas delivery started on November 18, 2007. The Turkey–Greece–Italy natural gas pipeline is the extension of the Turkey–Greece natural gas pipeline. Accordingly, the line would extend from Greece to Italy beneath the Adriatic Sea. BOTAS signed an agreement with DEPA and EDISON in order to participate in the feasibility studies into the Greece–Italy connection. On 31 January 2007, the authorities of Italy and Greece signed an agreement in Athens regarding the Adriatic crossing. The Intergovernmental Agreement of Turkey–Greece–Italy Natural Gas Pipeline (ITGI) was signed on 26 July 2006 in Rome. According to the Project studies; the natural gas volume to be transported to Italy by the Turkey–Greece–Italy Line would be approximately 13 bcm of which 3.6 bcm would be transported to Greece and the remainder to Italy. The Line is planned to become operational in 2013.

4.2.7. The West Balkans pipeline proposal

In considering the Turkey–Greece–Italy interconnector in Istanbul, DEPA also said that a plan for a West Balkans line was "under consideration but was not mature yet". An agreement to study the evolution and implementation of such a line was signed on 8 April 2003 between DEPA and BOTAS and the gas authorities of the Former Yugoslav Republic of Macedonia, Albania, Yugoslavia, Bosnia Herzegovina, Croatia and Slovenia. A study by the Observatoire Méditerranéen de l'Énergie (OME), carried out for the European Commission's Synergy Programme and presented in Istanbul, compared the Nabucco and West Balkans options with the Greece–Italy interconnector. It concluded that "projects to connect Turkey to Austria either through Bulgaria, Romania and Hungary, or through Macedonia, Bosnia–Herzegovina, Croatia, Serbia and Slovenia (or possibly both) are more likely to see the light, but will still require substantial political backing". However, these countries – with the notable exceptions of Romania and Croatia – have small gas markets. Moreover, they suffer from political and regulatory uncertainties and are mountainous. This proposal has therefore not attracted a real commercial interest and looks more like a long-term project. In terms of regional gas supply, such a line would play a significant role. But it is not a major concern with regard to overall European gas security unless it is specifically developed as a complementary system to the Nabucco project, linking Turkey not only with the Balkans, but also with a major European hub.

5. Conclusions

Fossil energy (oil, coal and natural gas) is the most important energy sources for modern human life. Energy demand, especially electricity and natural gas, of Turkey is projected to grow by 8% annually. It should be noted that approximately 74% of Turkey's energy demand is met by imports from other countries. Turkey has several projects about natural gas's usage in country and its transport to Europe. Also, this trend is likely to continue in the near future. In order to realize the aim of becoming the energy bridge between the West and East, Turkey should have an energy policy compatible with that of EU. Europe and Turkey are rapidly growing importers and consumers of natural gas, due to the fact that Turkey is surrounded by major gas exporting countries in the Middle East and the Middle Asia. It is expected that significant amounts of crude oil and natural gas will be transported via Turkey to the European countries in the near future. Turkey's plans to be the Energy Corridor fit well with the geopolitical structure of Eurasia region. Security considerations make Turkey an ideal place for natural gas pipelines.

References

[1] Kilic FC, Kaya D. Energy production, consumption, policies, and recent developments in Turkey. Renewable and Sustainable Energy Reviews 2007;11:1312–20.
[2] Erdogdu E. A review of Turkish natural gas distribution market. Renewable and Sustainable Energy Reviews 2010;14:806–13.
[3] Erdogdu E. Bypassing Russia Nabucco project and its implications for the European gas security. Renewable and Sustainable Energy Reviews 2010;14:2936–45.
[4] BOTAS, http://www.botas.gov.tr/dogalgaz/dg_arztaleb_sen.asp [accessed 23.11.10].
[5] MENR. Ministry of Energy and Natural Resources. Ankara, Turkey, http://www.enerji.gov.tr [accessed 12.01.11].
[6] Turkey's oil consumption. Ministry of Energy and Natural Resources, http://www.enerji.gov.tr/petrolarztalep.htm [accessed 12.06.08].
[7] Y. Isik. Turkey's Energy Prospects in the EU-Turkey Context; EU-Turkey Working Papers, Center For European Policy Studies; No. 9/October 2004, http://shop.ceps.be/Book Detail.php?item_id=1163 [accessed 09.02.10].
[8] Energy Information Administration. June 2005; Country Analysis Briefs-Turkey, Official Energy Statistic from US Government, http://www.eia.doe.gov/emeu/cabs/turkey.pdf [accessed 17.09.06].
[9] Hacisalihoglu B. Turkey's natural gas policy. Energy Policy 2008;36:1867–72.
[10] Energy Policies of the IEA Countries Turkey 2001 Review. IEA BOOKS-OECD/IEA; 2001; Paris, http://www.iea.org/textbase/nppdf/free/2000/turkey2001.pdf [accessed 11.05.05].
[11] Finon D, Locatelli C. Russian and European gas interdependence: could contractual trade channel geopolitics? Energy Agency 2008;36-1:423–42.
[12] BP. Statistical Review of World Energy, London, http://www.bp.com/downloads.do?categoryId=9003093&contentId=7005944 [accessed 25.08.09].
[13] TEIAS. Directorate-general of Turkish electricity transmission. Short history of electrical energy development in Turkey and some statistical figures, http://www.teias.gov.tr [accessed 02.10.10].
[14] Loskot A. Turkey and energy transit corridor to the EU, Warsaw: CES studies; 2005.
[15] International Energy Agency (IEA). Natural gas information. IEA Statistics; 2010.
[16] World Energy Council. Survey of energy resources; 2009.
[17] Eurogas. Natural gas demand and supply: long term outlook to 2030; 2009.
[18] International Energy Agency (IEA). Natural gas information. Paris: IEA/OECD; 2005.
[19] Cetin T, Oguz F. The reform in the Turkish natural gas market: a critical evaluation. Energy Policy 2007;35:3856–67.
[20] European Commission. Eurostat energy data, main tables, http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/main_tables [accessed 12.01.11].
[21] U.S. Energy Information Administration, EIA, Oil Information, www.eia.doe.gov [accessed 12.01.11].
[22] Internal energy agency, IEA, energy policies of IEA countries, Turkey; 2009.
[23] M. Piskur. The BTC pipeline and increasing importing of energy supply routes, http://www.pinr.com/report.php?ac=view_printable&report_id=537&language_id=1 [accessed 30.06.10].
[24] A. Külebi. Pipeline and seaport security, http://www.tusam.net/makaleler.asp?id=601 [accessed 03.08.10].
[25] Karagiannis E. Energy and security in the Caucasus, London; 2002.
[26] Kilic AM. Turkey's natural gas necessity, consumption and future perspectives. Energy Policy 2006;34:1928–34.
[27] Hoekman BM, Togan S. Turkey: economic reform and accession to the European union. World Bank; 2005.
[28] Economides MJ, Wood DA. The state of natural gas. Journal of Natural Gas Science and Engineering 2009;1(1–2):1–13.
[29] South Stream Pipeline. What is South Stream? http://southstream.info [accessed 01.03.11].
[30] Freifeld D. The great pipeline opera. Foreign Policy 2009;174:120–7.